

## I. Calculating Frequency & Wavelength of EM radiation

### A. Defining variables

- Example:*  
What is the variable that we use to represent frequency (Hz)? =
- What is the variable that we use to represent wavelength (m) =
- What is the variable that we use to represent  
Speed of Light (m/s) =  
Note: all Electromagnetic Spectrum waves travel at this same speed.
- Speed of light is a constant. How many m/s does light travel?

### B. Deriving equations

Given the formula .....  $c = f\lambda$

- What is the formula for calculating  $f$ ?
- What is the formula for calculating  $\lambda$ ?

### C. Calculating Frequency ( $f$ ) and Wavelength ( $\lambda$ )

Show your work! Use a calculator and do the actual math – don't just leave the answer as a fraction!

- Violet light has a wavelength of  $4.10 \times 10^{-12}$  m. What is the frequency?  
 **$= 7.3 \times 10^{19}$  Hz**
- Green light has a frequency of  $6.01 \times 10^{14}$  Hz. What is the wavelength?  
 **$= 4.99 \times 10^{-7}$  m**
- What is the wavelength (in meters) of the electromagnetic carrier wave transmitted by The Sports Fan radio station at a frequency of 640 kHz? (Hint: convert kHz into Hz by multiplying by  $10^3$ .)  
 **$= 4.7 \times 10^2$  Hz**
- Calculate the wavelength of radiation with a frequency of  $8.0 \times 10^{14}$  Hz.  
 **$= 3.75 \times 10^{-7}$  m**

## II. Calculating Energy & Frequency of EM radiation

### D. Defining variables

- Frequency (Hz) =
- Energy (Joules) =
- Planck's constant =

### E. Deriving equations

Given the formula .....  $\text{Energy}_{\text{photon}} = \hbar * f$

- a. What is the formula for calculating  $f$ ?

### F. Calculating Energy and Frequency ( $\mathcal{F}$ )

Show your work!

1. Calculate the energy of a photon of radiation with a frequency of  $8.5 \times 10^{14}$  Hz.

**$= 3.332 \times 10^{-19}$  Joules**

2. Calculate the energy of a gamma ray photon whose frequency is  $5.02 \times 10^{20}$  Hz?

**$= 3.332 \times 10^{-19}$  Joules**

3. Calculate the energy of a photon of radiation with a wavelength of  $6.4 \times 10^{-7}$  m.

**$= 4.426168 \times 10^{-19}$  Joules**

4. What is the energy of light whose wavelength is  $4.06 \times 10^{-11}$  m?

**$4.89988 \times 10^{-14}$  J**

### G. General Knowledge

- a. Rank these parts of the electromagnetic spectrum from lowest energy (1) to highest (7):
- b. Rank these parts of the electromagnetic spectrum from lowest frequency (a) to highest (g):
- c. Rank these parts of the electromagnetic spectrum from shortest wavelength (A) to longest (G):
- d. 14. What is the relationship between frequency and wavelength?  
(Direct or Inverse)
- e. What is the relationship between frequency and energy?  
(Direct or Inverse)